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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/562,678	02/24/2006	Joachim Rosler	P29080	8281

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EXAMINER	
D'ANIELLO, NICHOLAS P	

ART UNIT	PAPER NUMBER
1793	

NOTIFICATION DATE	DELIVERY MODE
11/07/2008	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/562,678	ROSLER ET AL.	
	Examiner	Art Unit	
	Nicholas P. D'Aniello	1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 29 November 2008.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1,2,5,7-11,13-15,21,23 and 26-28 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1,2,5,7-11,13,14,21,23 and 26-28 is/are rejected.

7)☒ Claim(s) 15 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendments

The Request for Continued Examination (RCE) filed November 29th 2008 is acknowledged. Claims 1, 2, 13, 21 and 26 have been amended, claims 3, 4, 6, 12, 16-20, 22, 24 and 25 have been cancelled and claims 27 and 28 have been added. A new ground of rejection is presented in this Office Action.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-3, 5-8, 10-11 and 16 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Egorova et al. ("Effect of the structure on the cutability of Titanium alloys") in view of Lederich et al. (USP 4,415,375 of record), Smickley et al. (USP 4,505,764 of record), Zwicker et al. (USP 2,892,742 of record) and Fisher et al. (US Patent No. 5,211,775 of record).

In regard to independent claim 1, Egorova et al. teach a method of machining a titanium alloy by performing a "hydrogen charging step" where the work piece is heated in a hydrogen containing atmosphere at a temperature of 750°C (approximately 973K) during which the work piece absorbs the hydrogen. The titanium work piece is then cut (metal-removing machining) and the hydrogen is released by heating the work piece in

a vacuum (hydrogen free atmosphere) (see provided document at least the abstract, introduction and methods of study). Although not specifically taught, a cooling step would naturally flow in the process of Egorova et al. since the work piece would be exposed to a natural cooling as it is removed from the furnace and exposed to an ambient atmosphere (ambient atmosphere is a hydrogen containing atmosphere).

Claim 1 differs from Egorova et al. in calling for a removal of the oxide layers and covering layers from the workpiece. However, it would have been obvious in the art to remove the oxide layers of the titanium work piece prior to heating because Fisher et al. teach a method of removing oxide layers from titanium work pieces (column 2 line 66 – column 3 line 3) because oxygen enriched area form very hard surface layers which low ductility which cause deterioration of strength and other mechanical properties in titanium (column 1, lines 49-52).

Claim 1 differs from Egorova et al. in calling for the hydrogen containing atmosphere to be under a pressure of approximately 5 kPa because the reference is silent regarding this pressure (although it is noted the object is to obtain the same degree of hydrogen absorption (0.5% H in Ti) as applicant, see table 4 of the reference). However, it would have been obvious in the art to use a pressure of around 6.9 kPa because Smickley et al. teach a method of refining the microstructure of titanium by heating the work piece in a hydrogen containing atmosphere where the pressure is kept constant around 1 psi (which converts to roughly 6.9 kPa) (column 9, *Example 1*). Approximately 5 kPa is taken to read on around 6.9 kPa. In any event, it would have been obvious to use a pressure of approximately 5 kPa because one in the art would

have reasonably expected that substantially the same desired result would be achieved as this is close to the pressure (around 6.9 kPa) taught by Smickley et al.

In the event that 750ºC is not taken to be approximately 973K, claim 1 also differs from Egorova et al. in calling for a specific temperature during the hydrogen charging step, however Lederich et al. teach a similar method for improving the machinability of titanium workpieces by hydrogen charging and the desirability to use temperatures between 600 and 760ºC which prevent grain growth and have the maximum hydrogen solubility (column 3 lines 43-50).

In the event the cooling step is taken to be embraced by Egorova et al., it would have been obvious to include a cooling step in the process of Egorova et al. because Zwicker et al. teach a process for improving the workability of titanium alloys using a similar hydrogen charging process where the hydrogen is later removed where the work piece is allowed to cool in the same oven after the hydrogen charging step prior to the hydrogen removal (column 2, *Example 1*). This is the same method proposed by applicant and is a simple method for insuring the hydrogen does not escape the workpiece due to a concentration gradient during cooling.

Regarding claim 2, Egorova et al. teach that the hydrogen is typically removed by heating the formed part in a vacuum (see introduction).

Regarding claim 5, Egorova et al. teach that the hydrogen charging step (annealing time in hydrogen containing atmosphere) is performed for ten hours prior to forming (page 138, column 1, paragraph 3).

Regarding claim 7, although Egorova et al. is silent regarding a quantitative value of the vacuum pressure it would have been obvious to use a vacuum pressure of least 2 $\cdot 10^{-3}$ Pa because Zwicker et al. teach that the hydrogen is removed under a high vacuum (column 2 lines 46-48).

Regarding claim 8, Egorova et al. teach, in one example, that the annealing temperature in the hydrogen free atmosphere (vacuum annealing) is performed at 800°C (page 138, column 1, paragraph 3).

Regarding claims 10 and 11, Egorova et al. teach that the hydrogen content introduced into the alloy should be between 0.1 and 0.7 weight percent to improve the formability (see table 4).

Regarding claim 13, Fisher et al. teach a method of removing oxide layers from titanium work pieces using an etching solution containing nitric acid (HNO_3) (column 2 line 66 – column 3 line 3)

3. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Egorova et al., Lederich et al., Smickley et al., Zwicker et al. and Fisher et al. as applied to claim 1 above, and further in view of Garg et al. (US Patent No. 4,902,535 of record).

Egorova et al. in combination teaches the method as presented in independent claim 1. Claim 9 differs from Egorova et al. and Zwicker et al. in calling for the heating to be carried out inductively, whereas the references are silent on the mechanism of heating. However, it would have been obvious in the art to use an inductive furnace because Garg et al. teach a method for depositing coatings on titanium where the work

piece is heated in an inductive graphite furnace which has hydrogen containing atmosphere (column 6, *Control 1*).

4. Claim 14 is rejected under 35 U.S.C. 103 (a) as being unpatentable over Egorova et al., Lederich et al., Smickley et al., Zwicker et al. and Fisher et al. as applied to claim 13 above, and further in view of Borowik (US Patent No. 2,974,021 of record).

The combination of references teaches the desirability to etch the oxide layer of a titanium work piece before improving the workability with a hydrogen charging step. Claim 15 differs from the references in calling for a composition comprising water, nitric acid, hydrofluoric acid and hydrogen peroxide for the etching solution. However it would have been obvious in the art to use a solution of hydrofluoric acid, hydrogen peroxide, nitric acid and water could be used because Borowik teach a solution for etching titanium containing 10 parts by volume of 48% C.P. <u>hydrofluoric</u> acid, 60 parts by volume of U.S.P. 3% <u>hydrogen peroxide,</u> 10 parts by volume of commercial 69.3% <u>nitric</u> acid, and 30 parts by volume of distilled water (column 2, claim 1).

5. Claims 21, 23 and 28 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Nagata et al. (USP 5,156,807) in view of Whang et al. (US Patent No. 4,512,826 of record)

The following is a section from the MPEP 2144.05 concerning the obviousness of ranges: In the case where the claimed ranges overlap or lie inside ranges disclosed by the prior art" a *prima facie* case of obviousness exists. *In re Wertheim*, 541 F.2d 257,

191 USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990); *In re Geisler*, 116 F.3d 1465, 1469-71, 43 USPQ2d 1362, 1365-66 (Fed. Cir. 1997) Similarly, a *prima facie* case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties. *Titanium Metals Corp. of America v. Banner*, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985).

Nagata et al. teaches a variety of titanium alloys which have improved machinability (abstract), disclosed are several Ti-Al6-V4 alloys in Table 1, for example see alloys number 17, 41 and 42 which contain either 1.53, 2.3 or 2.26 weight percent lanthanum respectively; which converts to approximately .5, .77 or .75 atomic percent lanthanum respectively where the rare earth metals (REM, such as lanthanum) forms inclusions (precipitates) which increases machinability (column 1, lines 51-53).

Nagata et al. forms the alloy by vacuum arc re-melting (VAR) (column 5 lines 54-61) which is the same method as applicant (instant specification at page 10 lines 4 and 5) it is reasonably assumed that the microstructure of the alloy is the same. Additionally, as there is no disclosure of oxygen or nitrogen in these inclusions (precipitates) it is reasonably assumed that they are devoid of oxygen and nitrogen. Due to the laws of thermodynamics, precipitates naturally nucleate at grain boundaries in cast microstructures and the size of the precipitates is a determined by the heat treatment which is well within the purview of one of ordinary skill in the art.

As to claim 23, Ti-Al6-V4 is always an $\alpha + \beta$ alloys due to the presence of Al and/or V.

In regard to claim 28, although complete precipitation is not specifically disclosed by Nagata et al., the machinability increases with the inclusion/precipitate formation (column 1, lines 51-53) therefore it would have been obvious to completely precipitate the lanthanum in the alloy of Nagata et al. in order to obtain maximum machinability.

6. Claim 26 is rejected under 35 U.S.C. 103 (a) as being unpatentable over Egorova et al. ("Effect of the structure on the cutability of Titanium alloys") in view of Zwicker et al. (USP 2,892,742 of record) and Fisher et al. (US Patent No. 5,211,775 of record).

In regard to independent claim 26, Egorova et al. teach a method of machining a titanium alloy by performing a "hydrogen charging step" where the work piece is heated in a hydrogen containing atmosphere at a temperature of at least 750ºC during which the work piece absorbs the hydrogen. The titanium work piece is then cut (metal-removing machining) and the hydrogen is released by heating the work piece in a vacuum (hydrogen free atmosphere) (see provided document at least the abstract, introduction and methods of study). Although not specifically taught, a cooling step would naturally flow in the process of Egorova et al. since the work piece would be exposed to a natural cooling as it is removed from the furnace and exposed to an ambient atmosphere (ambient atmosphere <u>is</u> a hydrogen containing atmosphere).

Claim 26 differs from Egorova et al. in calling for a removal of oxide layers from the workpiece. However, it would have been obvious in the art to remove the oxide layers of the titanium work piece prior to heating because Fisher et al. teach a method

of removing oxide layers from titanium work pieces using an etching solution containing nitric acid (HNO_3) (column 2 line 66 – column 3 line 3) because oxygen enriched area form very hard surface layers which low ductility which cause deterioration of strength and other mechanical properties in titanium (column 1, lines 49-52).

Claim 26 differs from Egorova et al. in calling for the hydrogen containing atmosphere to be under a pressure of approximately 5 kPa because the reference is silent regarding this pressure (although it is noted the object is to obtain the same degree of hydrogen absorption (0.5% H in Ti) as applicant, see table 4 of the reference). However, it would have been obvious in the art to use a pressure of around 6.9 kPa because Smickley et al. teach a method of refining the microstructure of titanium by heating the work piece in a hydrogen containing atmosphere where the pressure is kept constant around 1 psi (which converts to roughly 6.9 kPa) (column 9, *Example 1*). Approximately 5 kPa is taken to read on around 6.9 kPa. In any event, it would have been obvious to use a pressure of approximately 5 kPa because one in the art would have reasonably expected that substantially the same desired result would be achieved as this is close to the pressure (around 6.9 kPa) taught by Smickley et al.

In the event the cooling step is taken to be embraced by Egorova et al., it would have been obvious to include a cooling step in the process of Egorova et al. because Zwicker et al. teach a process for improving the workability of titanium alloys using a similar hydrogen charging process where the hydrogen is later removed where the work piece is allowed to cool in the same oven after the hydrogen charging step prior to the hydrogen removal (column 2, *Example 1*). This is the same method proposed by

applicant and is a simple method for insuring the hydrogen does not escape the workpiece due to a concentration gradient during cooling.

7. Claim 27 is rejected under 35 U.S.C. 103 (a) as being unpatentable over Egorova et al., Lederich et al., Smickley et al., Zwicker et al. and Fisher et al. as applied to claim 1 above, and further in view of Whang et al. (US Patent No. 4,512,826).

Egorova et al. in view of Lederich et al. teach a method for machining Ti-6Al-4V as applied to claim 1 (see column 3 lines 12-14 of Lederich, TiAl6V4 is one of the most commonly used titanium alloys). Claim 27 differs from the references in calling for a Ti-6Al-4V alloy with lanthanum in the content of 0.3 to 15 atomic percent. However, it would have been obvious in the art to include lanthanum because Whang et al. teach a method of precipitation hardening titanium alloys by adding a rare earth element (preferably lanthanum) in the amount of 0.1 to 2.0 atomic percent because it is relatively cheap (column 3 lines 37-43).

Allowable Subject Matter

8. Claim 15 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: Although Borowik teaches a solution for etching titanium containing 10 parts by volume of 48% C.P. <u>hydrofluoric</u> acid, 60 parts by volume of U.S.P. 3% <u>hydrogen</u>

peroxide, 10 parts by volume of commercial 69.3% nitric acid, and 30 parts by volume of distilled water (column 2, claim 1) this claim distinguishes over the prior art of record by defining the ratio of the components to differ substantially such that one of ordinary skill in the art would not consider the solution an obvious variant. More specifically, the composition in claim 15 requires a much larger concentration of nitric acid and much less hydrogen peroxide and hydrofluoric acid (see table below).

	Claim 15 (mL)	Borowik (parts)
Water	50	30
Hydrogen Peroxide	8.5	60
Nitric Acid	50	10
Hydrofluoric Acid	1.5	10
TOTAL	110	110

Response to Arguments

Applicant's arguments have been fully considered but they are not persuasive or are moot in view of the new grounds of rejection. Specifically, the majority of applicants arguments are against Lederich et al. which is drawn to superplastic forming instead of metal-removing machining, this is moot in view of the new grounds of rejection over Egorova et al. who is concerned with elongating the life of tools used to perform metal-removing machining of titanium alloy work pieces which is exactly the aim of applicants method as well.

In regard to applicants argument that the cooling process of Zwicker et al. would not be a hydrogen-containing atmosphere: this is not persuasive because the process described by Zwicker et al. (cooling the same furnace as the hydrogen charging) is exactly the same as applicant's process of switching the furnace off and leaving the workpiece to its own devices; and therefore it is reasonably assumed the furnace contains hydrogen, absent any evidence to the contrary, because there is no disclosure of modifying the furnace atmosphere. Further it is noted that atmospheric air contains a minute amount of hydrogen gas.

The argument against the assertion that a high vacuum obviates the claimed pressure in the vacuum is not persuasive as selecting a quantitative value for the vacuum is well within the purview of one of ordinary skill in the art, as such, specific vacuum pressure values are not disclosed in the references.

The argument in regard to claim 21 is moot in view of the new ground of rejection where the reference has the same alloy prepared by the same method disclosed by the applicant. Additionally as noted above the precipitate location is a natural function of thermodynamics during the heat treatment (grain boundaries are high energy sites that form precipitates); and precipitate size is a well known function of the heat treatment which one of ordinary skill in the art can control without undue experimentation.

Inquiries

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nicholas P. D'Aniello whose telephone number is

(571)270-3635. The examiner can normally be reached on Monday through Thursday from 8am to 5pm (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jessica Ward can be reached on (571) 272-1223. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/N. P. D./
Examiner, Art Unit 1793

/Kiley Stoner/
Primary Examiner, Art Unit 1793